

Pasteurella multocida Infections in 16 Persons in Oregon

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A REVIEW of Oregon State Public Health Laboratory reports from 1962 to mid-1965 revealed that subcultures taken from 16 persons had yielded *Pasteurella multocida*. These subcultures had been submitted by various hospitals and clinics for definitive diagnosis. Discovery of *P. multocida* in that many subcultures seemed unusual. A study of current medical literature, however, indicated that during the past few years an increasing number of cases of human infection from this organism have been reported.

History

P. multocida was among the first organisms to be identified bacteriologically. As early as 1886 investigators found this organism to be related to epidemic diseases of hogs, fowl, rabbits, and cattle. These organisms were considered saprophytic in the upper respiratory tract of animals where they appeared to remain for long periods (1, 2). In early bacteriological classification considerable confusion of the genus *Pasteurella* was caused by assigning to bacterial isolates a specific name relating to the host species from which it was obtained. Results of improved bacteriological studies and techniques subsequently showed, however, that these isolates belonged to a single species of *Pasteurella* with a variety of types and many strains—*P. multocida* (or many-killing) (2). The first apparent human case of local infection resulting from *P. multocida* followed a cat bite and was reported in 1939 (3, 4).

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Infections in man from *P. multocida* have been described in numerous articles. Isolations of the organism have been made from patients with frontal sinusitis, chronic bronchitis, and bronchiectasis who had no history of animal contact (1, 5-11).

Morphology and Cultural Characteristics

P. multocida is a small gram-negative ovoid rod that occurs singly, in pairs, and rarely, in chains and shows bipolar staining. These organisms are nonmotile, range from aerobic to facultatively anaerobic, and ferment several carbohydrates without forming gas. In appropriate media, H₂S and indole will be produced; growth is obtained on ordinary media. They do not liquefy gelatin, and bile salts inhibit growth. Four distinct serologic types, A, B, C, and D, have been recognized (12). Meyer indicates that, in addition to the direct agglutination test, the precipitin and capsular swelling test and the cross-protection test have been used to determine serologic types of this organism (3). *P. multocida*, like most gram-negative organisms, is sensitive in the test tube to chloramphenicol, tetracycline hydrochloric acid, and aerosporin; in the patient's body it is also sensitive to penicillin. Bacteriological procedures used to identify *P. multocida* are listed in table 1.

Epidemiologic Characteristics

P. multocida has a worldwide distribution and a wide host range, including rodents, small and large domestic animals, fowl, and man. The rate of infection in animals is not known, although many large epizootics caused by it have occurred in fowl, hogs, rabbits, and cattle (2, 13). Studies have shown that this organism

can be recovered from cultures of tonsils of more than 50 percent of apparently normal, healthy dogs (5). Chronic infections caused by *P. multocida* appear to be related to a decrease in the virulence of the parasite and to an increased resistance of the host. Highly virulent strains of the parasite have been observed during hemorrhagic septicemia outbreaks in cattle (13). Investigators have stated that from published and unpublished records a total of 162 human cases have occurred worldwide, with 5 deaths. Sixty of these cases occurred in France between

Table 1. Biochemical reactions of 16 cultures identified as *Pasteurella multocida* ¹

Test	Cultures tested			
	Total	Positive	Negative	Insufficient growth
Hydrogen sulfide ²	16	0	16	0
Urea ³	16	0	16	0
Gelatin.....	4	0	4	0
Motility.....	16	0	16	0
Methyl red.....	16	0	8	8
Voges-Proskauer.....	16	0	8	8
Indole.....	16	16	0	0
Citrate ⁴	16	0	16	0
Oxidase.....	14	0	14	0
Catalase.....	14	14	0	0
Nitrate.....	16	15	0	1
Endo-Agar.....	12	⁵ 7	5	0
Fermentations:				
Dextrin.....	3	0	3	0
Inositol.....	3	0	3	0
Lactose.....	14	⁶ 2	12	0
Maltose.....	9	0	9	0
Mannitol.....	14	11	3	0
Sorbitol.....	8	7	1	0
Sucrose.....	14	14	0	0
Arabinose.....	5	1	4	0
Dulcitol.....	5	⁷ 1	4	0
Rhamnose.....	3	0	3	0
Salicin.....	3	0	3	0
Xylose.....	7	4	3	0
Glucose.....	14	14	0	0

¹ Identified by Oregon State Board of Health Public Health Laboratory; 6 of these were submitted to the Communicable Disease Center (CDC), Atlanta, Ga., and confirmed.

² Triple sugar iron agar.

³ Christensen's method (W. B. Christensen: Urea decomposition as means of differentiating Proteus and paracolon cultures from each other and from *Salmonella* and *Shigella* types. J Bact 52: 461-466, October 1946).

⁴ Simmons' method (J. S. Simmons: A culture medium for differentiating organisms of typhoid-colon aerogenes groups and for isolation of certain fungi. J Infect Dis 39: 209-214, 1926).

⁵ Minute colonies.

⁶ 1 strain confirmed by CDC.

⁷ Confirmed by CDC.

Table 2. Clinical data from bacteriologically infections in 16 persons in Oregon, September

Patient's initials, age (years), and sex	Date of exposure	Type of exposure
L.Z., 50, F.....	Sept. 24, 1962	Multiple cat bites on left leg.
C.H., 55, M....	Feb. 4, 1963	Multiple cat scratches on both hands.
R.W., ¹ M.....	Feb. 7, 1963	Cat bite.....
E.D., 34, F....	Apr. 14, 1964	Unknown.....
J.Y., 49, F....	June 6, 1963	2 small lacerations from dog bites on dorsum and medial aspects of left hand.
H.L., 38, F....	July 18, 1963	Cat bite—second finger, right hand.
E.W., 72, F....	Sept. 10, 1963	-----
C.S., 4, F.....	Jan. 24, 1964	Cat bite—left cheek, 3 puncture lacerations and 5 small scratches.

¹ Age unknown.

1944 and 1954, and 30 were reported in the United States during the same period. Fifty percent were post-traumatic infections (14).

Clinical Signs in Man

In man, three different clinical syndromes related to *P. multocida* may be observed—chronic pulmonary infections, local infections, and systemic infections (5, 6). Chronic infections associated with illness caused by other organisms, such as nasal sinusitis, empyema, and bronchiectasis, have been observed even though

**confirmed cases of *Pasteurella multocida*
1962–April 1965**

Symptoms		Therapy	Remarks
Type	Duration (days)		
Cellulitis, inguinal adenopathy, general septicemia, wound drainage.	31	Chloromycetin 1 capsule 250 mg. 4 times daily for 4 days. 1,200,000 units penicillin intramuscularly for 4 days.	Hospitalized 21 days.
Indolent progressive infection into tendon sheaths of left hand.	54	Chloromycetin 3 gm. daily for 21 days at 7-day intervals (as required). 1,200,000 units procaine penicillin intramuscularly intermittently for 21 days.	Skin graft necessary.
Unknown-----	Unknown	Unknown-----	Physician records not available.
Pain and drainage from right ear, with fever, sore throat, chills, arthralgia, nausea, vomiting, vertigo. Right side tinnitus. Slight cervical lymph gland adenopathy.	7	600,000 units penicillin intramuscularly daily plus 0.5 gm. streptomycin sulfate every 4 hours. Aerosporin ear drops every 4 hours.	Chronic ear infections since 1951.
Inflammation, cellulitis around the areas of wounds with necrosis.	6	1 capsule terramycin, 250 mg. tetracycline 4 times daily, 3 days.	Debridement of wound area necessary.
Inflammation of finger with drainage from 1st phalangeal joint. Wound with persistent purulent drainage and ankylosis of joint.	Unknown	150 mg. deelomycin 4 times daily. 1,200,000 procaine penicillin intramuscularly and 250 mg. chloromycetin every 6 hours for 4 days.	Ankylosis of proximal interphalangeal joint due to osteomyelitis as result of infection.
Chronic productive cough with empyema and bronchitis and diffuse fibrosis in right 4th thoracic interspace. Some dyspnea and laryngitis.	10	Terramycin 1 gm. per day for 2 days. Sulfonamide, tetracycline 200 mg. every 6 hours for 2 days.	Patient was hospitalized.
Otitis media. Inflammation and spontaneously drained purulent material from left zygoma.	10	600,000 units penicillin daily 3 days. Triple sulfas (as required).	Wound was surgically opened and treated.

Table 2 continued on p. 1110.

P. multocida may also appear as a primary pathogen. In local infections, illnesses usually occur after animal bites and may result in frank osteomyelitis of the underlying bone when the wound infection is deep. Human infections have been characterized by slow healing and by a prolonged course with complications of necrotizing tenosynovitis and possible loss of function if articular areas are involved (10, 11).

Frequently, wounds caused by animal bites become infected after they are sutured, require prolonged treatment, and leave unsightly scars

(15). In the systemic form of pasteurellosis, both meningitis and bacteremia have been noticed; and when the central nervous system is involved, mortality may be high (3). Wound infections not related to animal bites have been caused by *P. multocida*. This organism has also been found in patients with mastoiditis, sinusitis, pyogenic arthritis, brain abscesses, pneumonia, pyelonephritis, endocarditis, and conjunctivitis (1).

In animals, the disease associated with *P. multocida* is usually an acute or subacute

Table 2. Clinical data from bacteriologically confirmed cases of in 16 persons in Oregon, September

Patient's initials, age (years), and sex	Date of exposure	Type of exposure	Symptoms	
			Type	Duration (days)
W.K., 78, M....	Mar. 24, 1964	Cat bite—dorsum of right hand.	Slight epitrochlear and axillary adenopathy. Wound area swollen, hot, tender.	4
M.A., 40, F....	Mar. 9, 1964	Cat bite—right index finger and dorsum of hand. Slight scratches.	Swelling, redness, extreme tenderness. Early cellulitis, purulent discharge from wound area.	14
M.B., 49, F....	June 6, 1964	Cat scratch—lower left leg.	Wound area tender, painful, some malaise, redness, and warmth. Erythematous left tibial area with central core. Septicemia at approximately 5 days.	10
H.B., 53, F....	June 12, 1964	Multiple cat bites and scratches of hand with 6 deep penetrating wounds.	Swelling in the wound area. Ecchymosis with purulent drainage from wounds.	6
W.S., 57, M....	Aug. 7, 1964	Cat bite—dorsum left hand.	Wound inflammation, edema of dorsum of hand and subcutaneous crepitation with drainage of purulent material.	3
L.I., ¹ F.....	Sept. 30, 1964	Dog bites upper and lower right arm and right anterior rib cage.	Local tissue necrosis, edema, erythema. All wound areas discharging fetid pus.	60
J.V., 70, M....	Dec. 24, 1964	Dog bite—dorsum of right hand.	Swelling and soreness. Wound area had considerable edema and cellulitis with slight drainage of purulent material.	7
H.A., 47, F....	Apr. 5, 1965	Cat scratch—dorsum right wrist.	Cellulitis, wound inflammation, subcutaneous abscess. Surface necrosis, edema of dorsum of hand. Surgical drainage of wound.	32

febrile illness of a septicemic or pneumonic type. The most commonly recognized illness in cattle caused by this organism is observed frequently after animals have been moved or transported to different ranges or sale yards. Most cattle raisers call the illness "shipping fever." Frequently, sudden outbreaks have occurred in livestock following the addition of a new member to the herd. Such occurrences may indicate a carrier state. Cattle of all ages

are susceptible, but the infection is usually seen in younger animals. As an epidemic progresses within a herd, the virulence of the organism appears to increase (13).

Cases in Oregon

Confirmed laboratory isolations of *P. multocida* in animals in Oregon average approximately 30 cases a year. These cases are evenly distributed between cattle and sheep with oc-

Pasteurella multocida infections
1962—April 1965—Continued

Therapy	Remarks
Procaine penicillin intramuscularly 1,200,000 units for 2 days.	Uneventful recovery.
1,200,000 units procaine penicillin intramuscularly for 4 days. Chloromycetin 1 gm. every 6 hours for 2 days.	Do.
Erythromycin and 1 capsule 250 mg. 4 times daily 500,000 units sodium nafcillin intramuscularly every 6 hours for 2 days.	Hospitalized for 5 days. Surgical drainage of super-patellar bursa. Uneventful recovery.
Initially sodium oxaceillin 500 mg. every 6 hours for 5 days. Final treatment chloromycetin 1 capsule 250 mg. 4 times daily for 4 days.	Minor surgery to establish drainage.
1,200,000 units procaine penicillin intramuscularly, 250 mg. terramycin capsule 4 times daily, 2 days. Panalba, two 125 mg.-capsules 4 times daily as required.	Hospitalized for 3 days.
Irrigation of wounds, debridement of devitalized tissue, ligation of small vessels. One capsule 4 times daily 6 days, 250 mg. chloromycetin.	Additional surgery required to restore function of lower arm and hand. Salivary swabs from dog's mouth 3 weeks after exposure, positive for <i>P. multocida</i> .
1,200,000 units procaine penicillin intramuscularly daily for 4 days. Debridement of dead tissue.	Hospitalized for 7 days. <i>P. multocida</i> recovered from dog's mouth 2 weeks after dog bit him.
Chloromycetin 250 mg. capsule 4 times daily 7 days. Surgical debridement of wound to establish drainage.	Anterior tendon disability. <i>P. multocida</i> recovered from cat's mouth 1 month after scratch episode.

¹ Age unknown.

casional isolates also from swine, deer, and miscellaneous animals. Reported clinical illnesses related to the *Pasteurella* organism average approximately 3,000 a year in a total beef and dairy population of 1,500,000 animals.

Examination of laboratory reports and medical histories in 16 human cases of infection with *P. multocida* in Oregon from 1962 to mid-1965 showed chronic purulent infections in all

the cases. Although serologic determinations were not available, standard bacteriological methods appeared to be satisfactory in identifying the organism.

Some investigators have found that only about 40–47 percent of patients ill with *P. multocida* have positive results when tested for agglutinins. C. R. Owen, Ph.D. (research microbiologist, National Institute of Allergy and Infectious Diseases, Public Health Service), has stated in a personal communication that, of 10 patients tested during 1936–61, only 4 showed the presence of *P. multocida* antibodies; of 5 such patients reported for 1964, only 3 reactors were detected. Owen is of the opinion that the number of patients' serums failing to show demonstrable *P. multocida* antibodies possibly indicates that examination by present serologic techniques alone cannot be considered adequate for identification of the causative agent.

Of the 16 Oregon cases, 5 resulted from cat bites, 1 from an ear infection with source unknown, 3 from dog bites, and 3 from combined cat bites and scratches. Three patients had histories of cat scratches only, and one patient had a history of chronic bronchitis for more than 10 years. Positive bacterial cultures were obtained from throat swabs of two dogs and one cat. Data abstracted from the patients' clinical histories appear in table 2.

Discussion

With 2 exceptions, the 16 persons in Oregon who became infected with *P. multocida* had been directly in contact with animals, and the bites and scratches of these animals were responsible for their infections. The preponderance of the infections resulted from cat bites. Unfortunately, the offending animals were not all available for study or for obtaining cultures. The majority of infections arising from bites and scratches were localized; septicemia or bacteremia occurred only in two cases. Wounds observed in the Oregon cases were highly painful and inflamed; in some instances serous exudate and purulent material was present for long periods of time and the wounds were difficult to heal. Although osteomyelitis did not

occur in any of the 16 patients, in 1 person it was necessary to allow a joint to ankylose because of the destruction of cartilage.

In this series of 16 cases, the more frequent occurrence of illness from cat bites and scratches in women than in men may reflect a sex difference in susceptibility to *P. multocida*. It more likely, however, reflects a preference of women for cats as pets, a predilection that provides this sex with greater exposure. Sufficient information was not available to compare the severity of infections caused by cats to the severity of infections caused by dogs. Such a comparison might help determine whether or not *P. multocida* from cats is more virulent than from dogs. Laboratory studies might aid in such a determination.

Some of the therapy and the methods used in caring for the wounds infected with *P. multocida* in these Oregon cases were apparently unsuccessful. The case data show that all animal bites and scratches require proper medical care and should not be left unattended. Wound infections would have undoubtedly been more severe without proper care, and systemic illness could have occurred. To determine the causative agent of such infections, laboratory procedures should be used.

Summary

A total of 16 human cases of *Pasteurella multocida* were diagnosed in Oregon between September 1962 and April 1965. Of these 16 cases, 5 resulted from cat bites, 1 from an ear infection with source unknown, 3 from dog bites, 3 from combined cat bites and scratches, and 3 from cat scratches only; in 1 case there was a history of chronic bronchitis.

In spite of intensive therapy in some of these cases, the wound infections persisted. They remained painful, hot, red, and swollen and frequently contained a dark and heavy, ill-smelling pus. Most patients recovered uneventfully and suffered no severe permanent damage from the infections. In only two instances was bacteremia or septicemia noted. There was no damage to the bony tissue beneath the wounds.

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